Refractory plasmonics: Evaluation of the nonlinear optical parameters of TiN thin film and TiN/PVA nanocomposite

R Sato[1], S Ishii[1], T Nagao[1], M Naito[1] and Y Takeda[1,2]
[1] National Institute for Materials Science, [2] University of Tsukuba
SATO.Rodrigo@nims.go.jp

Plasmonic nanostructures offer the remarkable prospect of concentrating and manipulating electromagnetic fields at the nanoscale. However, a fundamental understanding of the underlying mechanisms that give rise to the optical nonlinearities is poorly understood [1]. Previous studies were mainly performed at single wavelength and have led to conflicting results [2]. Better understanding of the nonlinear mechanisms would allow novel nanostructures to balance losses and maximize nonlinearities, and therefore, move the nanophotonics concepts forward to real-world applications.

The nonlinear optical properties of the TiN nanoparticles [3] embedded in PVA composite were investigated by pump-probe spectroscopy and spectroscopic ellipsometry [4], In contrast to the standard single wavelength Z-scan technique, the obtained changes in the refractive index range from 350 to 1200 nm. In light of these results, we discuss the effective and intrinsic optical third-order nonlinearity of the TiN nanoparticles in a broad wavelength region. These results can boost the applications of transition metal nitrides for ultrafast light manipulation in nanophotonics.

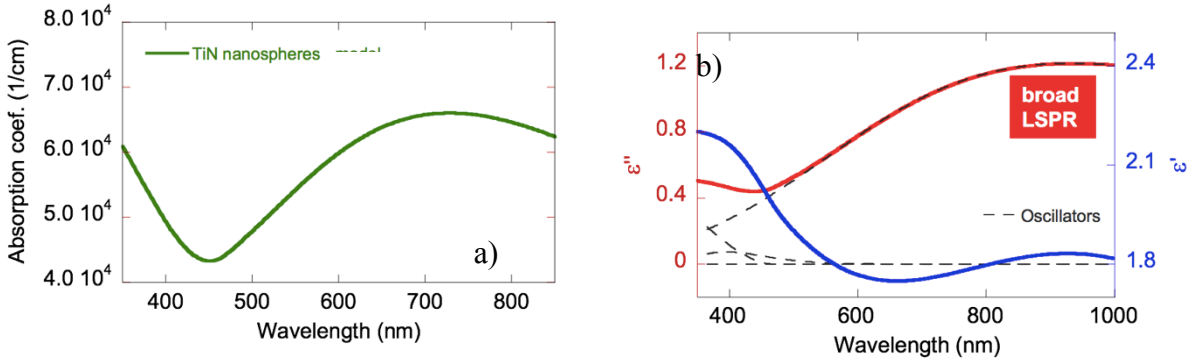

Figure 1: a) Absorption coefficient and b) complex permittivity of the TiN nanoparticles in PVA matrix.

References

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